

ABSTRACT OF THE DISCLOSURE

A main object of the present invention is to provide a liquid crystal LCD device element of frequency modulation mode enabling high speed on and off control of on and off of an electro-optical response at high speed by switching the frequency of applied electric field. and further, The LCD device element is capable of changing a frequency modulation range freely, from several Hz to few score kHz or more. The present invention attains the above mentioned object by providing a liquid crystal. The LCD device element comprising has a pair of parallel substrates; conductive layers provided respectively on facing inner surfaces of these between two parallel substrates; liquid crystal (LC) alignment layers provided respectively with pre-tilt angle on facing inner surfaces of these conductive layers; and a liquid crystal LC layer formed in between the two these pair of liquid crystal alignment layers., wherein LC liquid crystal soluble particles, (comprising a core composed of nanoparticles composing a core and a liquid crystal molecules or liquid crystal-like molecules provided on its periphery), are dissolved or dispersed in the above mentioned liquid crystal LC layer, and a A control circuit of applying voltage while modulating at least frequency among frequency and voltage is provided on the conductive layer for varying light transmittance of the liquid crystal LC layer, and under a Under a constant applied voltage, an electro-optical response as a light modulating device element is turned on by switching the frequency of applied electric field from low frequency to high frequency, and the electro-optical response is turned off by switching the frequency from high frequency to low frequency. Under this state,

~~an~~ The electro-optical response can be~~s~~ varied also by varying voltage, and this is a high-speed response having a time constant of several ms or less.